Tools of the Trade: The Role of Perceptions and Context in Designing and Developing Instructional Learning Aids

Sherry Kollman, University of Oklahoma
Patricia L. Hardré , University of Oklahoma

Abstract: Design principles, theories and artifacts from instruction in many fields have been analyzed from various perspectives. Instructional learning aids (ILAs) such as workbooks and job aids are components of instructional packages that are often utilized, but not often considered in terms of their role in learners' experience of instruction. We used a mixed methods approach to examine the effects of two types of ILAs for the design skill development of 11 graduate students over two sequential semesters. As designers, we depend on general principles, and may draw on principles from various frameworks to address particular design demands. But how do the unique aspects of content, context and learners' perceptions influence the use and effectiveness of those tools we create? In this nine-month study we examined learners' perceived utility and actual utilization of two distinct types of instructional aids designed for the sequenced instructional design courses. Learners' utilization of these tools varied depending on the tools' specific design elements, features of the contexts, and the match of intended use with learners' perceptions—demonstrating that perception (not intent) drives use. These findings inform strategic reasoning and practice in the design of ILAs for both the academic and practitioner.

Keywords: instructional design, instructional aids, learner workbooks, performance aids, perception and utilization

Designers in primarily academic educational settings and those who generally work in training and development settings tend to utilize different types of design strategies and solutions, often more out of comfort and ease of use than from systematic design reasoning. In this project, we took two types of instructional aids frequently used in business training and tested them in a graduate instructional design class. With the development of new technologies, teachers and trainers rush to test the effects of digital aids, but rarely step back to examine the value of more conventional learning aids in unconventional contexts. Despite the burgeoning of digital tools, there are myriad situations and contexts in which paper-based versions are still used. In this study we assessed the effects of tool type and design features of two traditional types of

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instructional aids, both electronic and paper based (a workbook and a flipbook-type job aid), including their interactions with learner perceptions and context.

Background

The nature of expertise in ID is complex, and it has been classified across types of skills, from straightforward procedure (in its simpler applications) to complex and ill-defined problem-solving or innovation design (in its more unique applications) (Brown & Green, 2006; Goel & Pirolli, 1992; Owen, 2007). Efforts to clarify and define the field include sets of core processes or skill competencies and codified professional standards, both general and field-specific (e.g., Cross, 1990; Goel & Pirolli, 1992; Richey, Fields & Foxon, 2001). Expert and competent practice in ID encompasses elements of systematic application of principles from learning and instructional theory (Cox, 2003; Dick, Carey & Carey, 2009). It also includes elements of flexibly-adaptive subjective judgment, refined by depth of knowledge and range of practice (Christensen & Ogusthorpe, 2004). Some ID roles involve repetition of the same rote skills, while others require innovative applications of principles for every project (Cennamo & Kalk, 2004).

An important aspect of ID is that skill and practice are deeply situated in contexts-of-use (Goel & Pirolli, 1992). While basic concepts and principles generalize across outcomes and domains of learning, selection and application of strategies are often constrained by contexts of instruction and performance (Cennamo & Kalk, 2004). Similarly, the development of competence in ID is situated in the learning experience (Quinn, 1994), and in the range of opportunities found to build schema for later recall and transfer of those skills (Fadde, 2009; Gagné & Medsker, 1996). Beyond basic knowledge and process skill, more elusive elements of ID are expert and difficult to define, alternately termed "design thinking", "design judgment", "design character" or "design expertise" (Boling, Easterling, Hardré, Howard & Roman, 2011; Brown & Green, 2006; Molenda & Boling, 2008).

Instructional Learning Aids

The design features of primary presentation material and instructional learning aids (ILAs) can influence learners' ability to engage, apply and recall information that is presented in classroom or training settings (Smith & Ragan, 2005). If designed with consideration of the learners, learning environment, and facilitator, an ILA can be a tool to maintain engagement and guide learners to build usable schemas in the skill set (Rossett & Schafer, 2007; Lizzio & Wilson, 2007). If designed with consideration of the performance task and future application, the ILA can also serve as a reference and job aid (Smith & Ragan, 2005; Rossett & Schafer, 2007) that learners utilize to support *use* of knowledge and skills.

If there is a need to create active learning environments to accommodate and assimilate information, there is a need to identify and research design of supporting tools that provide the opportunity to work with, personalize, and reflect on, information within the context of learning environments. The overarching question guiding this work was: What are the decisions that instructional designers need to consider when developing instructional aids, with particular attention to learners' perceptions and application of presented material?

Very few examples of data-driven research studies can be found on this topic (as we discovered from searching a broad set of terms such as learner workbooks, learning aids, participant guides and user guides). The term "workbook" did reveal studies that examined online workbooks, elementary school workbook practice (Block, Collins, Parris, Reed, Whitely & Cleveland, 2009), and a reflection workbook (Lizzio & Wilson, 2009), but these studies only examined one of the characteristics in which we were interested. Our search of existing literature yielded little scholarly work and even less applied design research. There were studies of technology-based learning systems and aids, but these tend to focus on the digital tooling and system features, rather than on the more basic design features of the aids themselves. Most ILAs can be delivered in various media and systems, and our interest was not in the media, but in the effects of basic design strategies that could be flexibly implemented.

One only needs to attend training and development in any educational setting, company or organization, or an industry job site, to recognize that traditional ILAs (such as workbooks and handheld job aids) are still widely utilized. Some have been converted, or imported without significant redesign, into digital formats (just as much of e-learning is essentially the importation of existing materials into digital delivery systems). The premise of developing an ILA or supporting performance tool is to enhance engagement, learning and job performance. However, we need design strategies grounded in theoretical foundations of education and demonstrated as effective, to know that our instructional aids actually will support learning and skill development. In this project, we stepped back from technology to examine learners' response to, and use of, traditional ILAs for learning a complex, highly cognitive, applied skill set such as designing instruction.

Design Principles for Learning Aids

Before beginning the project, we also reviewed the existing literature relevant to designing ILAs and distilled principles to use in our design and development. The design principles for instructional learning aids and performance job aids present implications for thinking and learning, through the paths of human cognitive processing as reflected in research-based principles of design. Decisions on these characteristics are informed by learner, content and contexts characteristics that we generate in the design analyses. Principles grounded in basic design features are captured in Table 1.

Research-based Implications for Design of ILAs

Learners can only handle small amounts of information in working memory (Ormrod, 2008; Paas, Renkl, Sweller, 2003). During the brief time of initial cognitive processing, learners attempt to make connections by accessing stored information from long-term memory. To increase cognitive understanding, learners need the opportunity to interact richly with information, which stimulates cognitive review and practice (Makany, Kemp & Dror, 2009), and maintaining learners' attention is key (Dudukovic, Dubrow & Wagner, 2009). If connections are not made, learners are likely to lose key pieces of information (Ormrod, 2008). Material should be organized and structured in design so that learners are encouraged and supported in using learning aids as appropriate, and then challenged to use skills more independently as they develop competence (Smith & Ragan, 2005). Information should also be ordered and grouped so that learners can use it to develop accurate but personally meaningful schemas (Dick, Carey & Carey, 2005). These strategies all influence cognitive processing, initial understanding and eventual recall and transfer of skills. In designing instruction it is important that learners have relevant tools available to apply and practice target knowledge and skills.

As ILAs move from training to transfer, as job aids, their design features need to support learners to actually use them as reminders, checklists or reference guides (as appropriate to the tasks and tool). As job aids, ILAs need to promote speed of reference and efficient cueing for learners to accurately recall the necessary and relevant information that enables them to effectively perform tasks. These outcomes depend on design features like organization that concisely captures key content and makes it accessible as needed, and on visuals and graphics that can be quickly understood and linked to task components (Dirksen, 2012). Issues like legibility of typographic elements (e.g., fonts) have been the subject of decades of research and debate, leading to the conclusion that not one single factor but the fusion of the whole presentation drives clarity and use (Bix, 2002).

Analyses Informing Design Decisions

Building on the research-based findings and principles, designers take into account specifics of a given learning dynamic, based on analysis of the learners, task, content and contexts. Some key characteristics of our learning dynamic are identified in the following sections.

Learner characteristics. In general, adult learners need and want information to take back and apply (Knowles, Holton & Swanson, 1998; Kenner & Weinerman, 2011), so instructional aids need to be designed to provide task-relevance at some level to

Table 1: *Design Principles and Features of Learning Aids*

Features & Principles	Relevant Strategies for Instructional Learning Aids
Feature I: Layout Keep layout consistent throughout. Design layout for learner needs and intended use.	**Margins:** Margins need to allow for final packaging (e.g., binding, 3-hole punching, stapling, two-sided printing). **Columns:** Columns need to consider embedded elements (e.g., charts, space for writing) and aesthetics (e.g., grouping, discriminating between items). **White Space:** Include room needed to interact, take notes, create, capture ideas, provide resources needed for reference.
Feature II: Graphics Design and place visual and graphic elements to enhance meaning and understanding.	**Placing Graphics:** Graphics must be clearly related to content and placed proximate to relevant content. **Design of Graphics**: Illustrations and representations are selected and presented so that they best support learner understanding, illustrate complex concepts and processes, and minimize misconceptions.
Feature III: Typography Arrange typography to direct learner attention, support understanding. Keep typography consistent throughout materials, so learners focus on content rather than on decoding.	**Type size**: Balance space allowances and learners' needs such as visibility. Most uses feature type sizes: 10, 12, 14, and 16. Use larger type sizes for headings as appropriate for materials. **Fonts:** studies disagree on how fonts effect learning, so they should be considered as a whole with other textual and typographic elements. **Spacing:** Consider the effects of vertical and horizontal spacing on learners' eyes and attention. **Ensure Consistency:** Prepare style sheet for development.
Feature IV: Visual Aesthetics Consistent aesthetic enhancements, such as color and balance promote engagement and utilization.	**Color scheme:** Embed a consistent color scheme throughout all material to create coherent, consistent professional look. **Visual Balance**: Overall balance of elements on a page effects learner attention and may support (or reduce) later location for reference.
Feature V: Content Concisely capture key content to supplement training and cue later recall for task use.	**Balance content:** Keep ILAs concise, but supplement key content ideas, cues for skill use, and effective memory cues, such as mnemonics, model elements, and rules-of-application. **Scaffolding and Fading:** Present more material and remove scaffold progressively.
Feature VI: Content & Organization Order and organize information to support learners creating accurate and accessible personal schema.	**Sequencing:** Present foundational material at outset, to establish foundation. Balance cognitive load of new and complex information. **Clustering:** Group related information together to support understanding of relationships.
Feature VII: Media & Access Integrate media with information to maximize use.	**Integration:** Integrate information with media features, to maximize access and support use and later application. **Interacting:** Provide space and access for interactivity that supports reflective learning and applied practice.

each learner. Our adult learners wanted a learning environment that provided usable tools and the opportunity to practice, so they would leave the classroom knowing they could utilize those skills (Knowles, Holton & Swanson, 1998). As graduate students and practitioners, our learners needed ILAs linked to their curricular requirements, to facilitate success on their instructional design requirements. As novice designers, they also needed tools that reflected authentic professional skill requisites and would help them transfer strategies to other applied design contexts beyond the classroom. Learners in these courses previously expressed perceptions of particular challenges (such as applying design adaptively to more effectively meet different needs), so the ILAs were explicitly designed to address those needs. As graduate students and competent professionals, equipped with successful study and task strategies, our learners wanted to be independent and autonomous in their work (e.g., Hardré & Burris, 2012; Hardré, Ferguson, Bratton & Johnson, 2008). However, as relative novices in design, they needed significant support in the specific knowledge and strategies of ID (e.g., Hardré & Chen, 2005; Hardré, Ge & Thomas, 2007).

Content and task. Given the adaptive nature of the task of design, ILAs for this skill set needed to allow for them to be used across a range of possible projects. However, they still needed to be consistent in supporting the application of the key information and principles of the field, and be tied to the professional standards of practice. Because they were being used in the introductory-level course sequence, having the information organized in ways linked back to the texts and other course materials supported coherence in learners' understanding of the field.

Context-of-learning. In analyzing the utility and practicality of the design to create ILAs a designer must consider the different activities occurring in the learning environment, as well as how learners will interact with the tool. The two ILAs created for this project were different in their functions, aims and relations to the learning and performance environments. However, both were intended as tools for use both in and outside of the instructor-led class, to assist in content retention and to support their application to individual and collaborative design tasks.

Context-of-use. A well-designed ILA should serve as a reference tool after the lesson has been completed. Such a tool needs to provide cues and triggers that facilitate learners' use of knowledge and skills, often done effectively with participation by learners themselves (Rossett & Shafer, 2007). Use of an ILA for unique task work (like ID) can continue to evolve as learners incorporate the aid into their own situations. Integrating an ILA into a lesson or training can help ensure consistency for content learning (Rossett & Shafer, 2007) and provide structure to promote transfer, balanced with flexibility as learners interact and customize their use.

Research Purpose and Questions

The overarching inquiry for this project focused on learners' perceptions and utilization of two custom-designed learning aids. We sought to identify and discriminate among perceptions and degree of utilization that learning aids (learner workbook and design job aid) could generate. We wanted to better understand how the specific design elements of ILAs can support and engage learners, with attention to context elements of learning and performance environments.

Methods

We set out to identify learner perceptions and degree of utilization, along with attributions of developmental contributions from the ILAs (learner workbook and design job aid). The learners all volunteered (consistent with IRB requirements) to participate in a study of the course design elements, but the project materials did not specify the ILAs as a focus of the study, to avoid leading or biasing responses.

The researchers were also the materials designer (Researcher #1), and the course instructor (Researcher #2), and as such we were aware of the potential for bias toward positive findings. To control for bias (consistent with Marshall & Rossman, 2011), we: 1) acknowledged our dual identities and consciously divided duties to reduce implicit approval messages; 2) designed with the strategy of multiple, independent, confirmatory data sources requiring con-

vergence (triangulation); 3) adopted roles of systematic observation and transparency, including crosschecking for bias; and 4) in the data analysis utilized both analytic induction and constant comparative analysis, requiring continuous checking and confirmation.

Learners

Learners were 11 graduate students enrolled in two sequential design courses (ID I & II), who progressed together through the academic year. Age ranged from 23 to 50, and gender mix was 8 (73%) female, 3 (27%) male. Ethnicity of participants included: 9 Anglo/White, 1 Latino/Hispanic, and 1 Asian/Chinese/Korean. The participants' majors and status ranged from first-year ID master's students to doctoral students in fine arts and educational psychology. All were described (by themselves and by the researchers) as novice designers. About half of the students had not previously used a learner workbook and none had previously used a tool like the job aid.

Learning Aids

Two new learning and performance aids were introduced during the two-semester course sequence, as productivity tools for the students. The aids were systematically introduced in two sequential courses, one each semester, to supplement existing instruction. They were embedded in the normal instruction of the courses. Early in each semester, the instructor introduced the tool, explained its purpose, guided and coached its use, then progressively left learners to judge when and how to use it. Both ILAs were provided to the learners at no cost.

Learner workbook. The first-semester ILA was a *learner workbook* (i.e., participant guide, learner guide) (seminar-type, 8 ½ x 11") that scaffolded learners in reflecting on and applying the text and class content in ID I. It was *explicitly content-focused*, because the ID information was seen as both complex and unfamiliar by previous learners in the first course. The workbook was designed, developed and presented complete to the learners with their other course materials the first week of class. The workbook design was categorized by class sessions and topics, to align with course content. Its key design elements included note spaces for each class session, and reflection areas encouraging learners to think through and apply what and how they were learning. By engaging in these sections, learners were able to capture "aha" moments for each class session and topic. It was accompanied by a cd containing a digital version (pdf) of the workbook, to allow users flexible access and provide portability of the content.

Design job aid. The second-semester ILA was a *design job aid* (pocket-sized, spiral-bound, flip-book type) that scaffolded learners in extracting ID principles and translating them to practice for the varying design tasks that they were challenged to complete in ID II. It was *explicitly task-focused*, because (from previous groups) the rapid production of ID deliverables was seen as the most challenging and daunting new component of the second course. In the interest of both exercising their design reasoning and gaining commitment to the ILA, the job aid was presented partially designed, and students were asked to contribute to the final design decisions as to its appearance and exact configuration for use. The content was outlined utilizing Gagné's Nine Events of Instruction to leverage those structural tools they had learned in ID I and bridge to the types of design decisions they would make in ID II and in their later professional practice. Each aspect, from size to spiral binding to the colored cascading tabs, was reasoned based on learner needs and task demands. Additionally, keeping the content short and to the point, delivered in bullet list format, efficiently provided the cues needed to assist learners in recalling the key information for designing their instructional projects.

Both ILAs were designed and delivered in hard copy (paper), printed in color. After the job aid was implemented, some of the learners asked for a digital version, so we developed an interactive digital reproduction of the job aid (in Adobe Flash). We uploaded it into the course LMS where it was accessible to all learners. Using the tracking tools inside the LMS, we were able to determine who accessed the digital aid, as well as the frequency. Table 2 shows a comparison of the design features of the ILAs.

Table 2: *Comparative Characteristics of the Instructional Learning Aids*

Comparative Characteristics of the Instructional Learning Aids		
Design Features	**Learner Workbook**	**Design Job Aid**
Layout	8 ½ x 11 inches, 86 pages, spiral bound, heavy stock paper, printed on both sides, illustrated cover. Textual content in outline form, space for writing applications and questions Designed as self-contained, interactive tool for learners to document ideas, applications related to course content. Provided white space for learners to document responses.	7½ x 8½-inches, 23 pages, laminated card stock, illustrated cover. Top spiral binding, cascading layers to distinguish sections of tool. Designed with bullet points, concise terms for quick reference, no internal interactions, tool to apply on external projects. Used white space to distinguish among types and levels of information.
Graphics	Illustrated with charts and other graphics to illustrate key points of content. Symbols throughout cued individual and group interactions and activities.	Global graphic framework guided user to reference and apply design strategies.
Typography	Used font size and embellishments (bold, italics) to guide learners' attention and promote understanding.	Used font size and embellishments (bold, italics) to guide learners' attention and promote understanding.
Visual Aesthetics	Incorporated color to guide attention, cue actions, and stimulate positive affect. Visual balance achieved with columns and placement of tables and graphics.	Color scheme discriminated among eight types of learning outcomes. Visual balance achieved with placement of graphic and text examples.
Content & Organization	Content aligned with class meeting topics and readings. Organized around course schedule, sequentially. Sections included information, course reflection & application activities (individual, group), professional examples.	Content aligned with Gagne's Nine Events of Instruction. Organized around eight learning outcomes, from sequential class assignments. Sections included definitions, design strategies, examples.
Media & Access	Paper-based, digital (pdf) version on cd	Paper-based, digital (Flash) version online

Data Sources

Data sources included: questionnaires designed to assess perceptions of the aids, periodic independent observations of utilization by two researchers and metacognitive essays. In order to identify their role in students' learning and skill development, assessments tracked students' use of and responses to the ILAs, as aids-to-learning-and-practice. The ILAs were integrated into the authentic design course experience that included experiential learning and independent projects.

In addition to the measures listed below, we assessed learning and design performance as part of both semesters' courses, through design products, both individual and collaborative. To determine how the learners used the ILAs and what they learned from them, we depended to a degree on the students' independent attributions of influence of the ILAs, provided in their written essays. Table 3 shows a summary of the data sources and timing of data collection.

Questionnaires

Sets of questionnaire instruments were customized to assess students' perceptions of the ILAs each semester. They also reported behavioral interaction with, and use of, the ILAs, such as how frequently

Table 3: *Data Collection Activities/Sources*

Week in Study	Data Collection Event
ID I	
2	Distribute Productivity Tool #2 Learner Workbook (LWB)
3	Obs #1: Participation, Interaction & LWB Utilization
4	LWB Questionnaire Time 1
5	Obs #2: Participation, Interaction & LWB Utilization
7	Obs #3: Participation, Interaction & LWB Utilization
8	LWB Questionnaire Time 2 Obs #4: Participation, Interaction & LWB Utilization
10	Obs #5: Participation, Interaction & LWB Utilization
13	Obs #6: Participation, Interaction & LWB Utilization
ID II	
20	Distribute Productivity Tool #1 Job Aid (JA)
23	Obs #1: Participation, Interaction & JA Utilization
25	JA Questionnaire Time 1
27	Obs #2: Participation, Interaction & JA Utilization
29	Obs #3: Participation, Interaction & JA Utilization
30	JA Questionnaire Time 2
31	Obs #4: Participation, Interaction & JA Utilization
32	Obs #5: Participation, Interaction & JA Utilization
33	Obs #6: Participation, Interaction & JA Utilization

they used them without prompting by others. These were given multiple times to document any measurable change. They were not parallel forms, so the comparisons of the differential responses to the two ILAs are not direct and deductive, but inductive and based on the multi-source data.

Learner workbook. Questionnaires assessed student perceptions of the ID I learner workbook, including: value, utility, usability, application, and satisfaction with the workbook as a tool to strengthen ID knowledge (administered weeks 4 & 8). The 12 (6-point) Likert-type items, were followed by prompts for additional descriptive detail to support those numeric responses. Sample items: "I understand the benefits of recording findings from the in-class activities in the learner workbook" (followed by) "Please identify those benefits".

Design job aid. Perceptions of usability and application of the ID II design job aid were assessed with an original 12-item instrument. Items included Likert-type (e.g., "I am using the job aid to assist in recalling differences in each of the assigned instructional designs"); dichotomous (e.g., "The job aid anchored in Gagné's nine events of instruction, assisted me to embed the strategies to my own instructional design"); checklist/selection type (e.g., "During the course of the class the events within the job aid that I referred to the most often were…[followed by list]"); and generative items (e.g., "What changes you would make to the job aid to better assist you in your process of designing instruction?").

Observations

Two independent observers recorded observations of students, individually and in groups, across a range of behaviors and characteristics. Both observers produced data in quantitative and qualitative forms. Three times each semester, the *instructor-designer* recorded observations of students' in-class design activities. Dates were set *a priori* based on the class schedule. Three times each semester, the *external researcher-designer* made random visits for systematic observations of learners' design activities. The researchers used an observation protocol that ensured consistent application across users and instances.

Metacognitive essays

At the end of each semester course, students were assigned to write metacognitive essays reflecting on their ID learning and skill development. Relevant content in these essays reflects the role of the ILAs from students' perspectives (for examples see Table 4).

Findings

Tools of the trade need to be designed with the same attentive analysis as a full instructional product. The study data reveal that design decisions need to consider the product as it will be used holistically, from the role of the instructor or facilitator to parallel content in other sources. The data also underscore that it is *perception, not intent*, that drives overall success of ILAs.

As part of the larger study and the course in which it was embedded, learning and performance were measured, but because this was not a controlled experimental study, we could not explicitly separate out the effects of the job aids on those outcomes. Two indicators suggest differential contributions of the ILAs to design learning, one indicates that the use (vs. non-use) of the ILAs promoted greater learning across students, and the other that students' attributed more positive effect on their design development to the second ILA (the job aid) than to the first ILA (the workbook).

We saw a pattern of more improved understanding and higher final performance in those students that more actively used the ILAs. However, these were also consistent with their engagement and participation in other course activities, so we could not separate out the contributions of these design variables, and the possibly differential effects of tool-specific versus general motivation for learning. We did explicitly measure and below report the learners' attributions of effects on learning and performance to the ILAs. Patterns of behavioral interactions with the ILAs (such as frequency of use) were treated as emergent differences based on the data. Detailed findings for each ILA are presented in the following sections.

Learner Workbook

Perceptions. For the learner workbook (ID I), in terms of perceptions, learners recognized its primar-

ily content focus, and saw it as linked to learning about ID, similar to the texts and class notes. They perceived some redundancy in having multiple sources of similar information and supports (though each resource contained unique information and supports in addition to the overlap). They perceived it as having only moderate value to their overall learning experience (5 of the 11 students rated its value a 3 out of 6, and 4 rated it a 2). Their qualitative comments reflected similar patterns of perceptions. They reported that it provided an additional source of what they viewed as very similar information, and due to the perceived redundancy found it only minimally helpful for their skill development and design work. Learners attributed little of their learning and skill development to the first ILA, though it was consistent with all of the design and learning principles from resources in scholarship and practice. The pragmatic application of referencing an 86-page workbook to assist in designing instruction was the primary rationale for the negative perception and lack of utilization. Table 4 shows the pattern of perceptions for both of the ILAs.

Table 4: *Patterns in Perceptions of the Instructional Learning Aids*

Learner Workbook (ID I)		
Measure	**Mean/Frequency Responses**	**Generative Comments**
Ability to use learner workbook participating in class activities and exercises	Mean = 3.41 (1-6 scale)	"I don't feel the workbook assisted my learning. . . . lacked integration in actual practice." "I don't feel the learner workbook assisted in my overall learning of the content. . . . I did not utilize it. It seemed to be extraneous."
Attributes learning of new *knowledge and information* to learner workbook	Mean = 3.76 (1-10 scale)	
Attributes learning of new *applied skills and strategies* to learner workbook	Mean = 3.76 (1-10 scale)	
Design Job Aid (ID II)		
Measure	**Mean/Frequency Responses**	**Generative Comments**
Using the job aid to assist in recalling key information for instructional design projects	In-Class: Mean = 3.09 (1-6 scale) Outside: Mean = 4.82 (1-6 scale)	"I liked that the job aid had all of the types of learning together in one spot. I could easily flip through the pages and compare/ contrast for the different types of knowledge." "I used the job aid to design the overall strategy. It reminded me of all the things I needed to include, so I was more open to be creative with the ideas to map into the strategy." "I felt the cascading component of the aid was easy to use as well as the color coding."
Frequency referencing paper-based job aid.	6 at least weekly 5 less than weekly	
Frequency of referencing online job aid.	1 once to view 10 never	

Utilization. Learners reported infrequent overall utilization outside of class (0-5 uses; average of 2 times-per-student), and only minimal additional use was observed in class by both researchers (0-4 uses; average of 2 times-per-student). More than half of the students tended to use it when cued by the instructor**.** Though they had been provided with a digital version of the workbook, these learners were not observed using it, and did not report doing so.

Design Job Aid

Perceptions. Learners recognized the task focus of the job aid, and saw it as a direct aid in producing their design assignments. They reported a high perceived value for this tool (all 11 learners said that they found it valuable, both inside and outside of the classroom). They perceived it as unique in content (though its core information was also replicated in the texts and class notes). Their feedback reflected similar patterns of perceptions. They reported that the job aid provided a unique source of helpful information, and found it extremely useful in promoting success in their skill development and design work. Learners reported gaining much in task efficiency and skill development from using the job aid. They said that using it caused them to recall and use the related design and learning principles from the course and texts.

Utilization. Learners reported frequent utilization outside of class (2-10 uses; average of 5 times-per-student), and additional frequent use was observed in class by both researchers (3-8 uses; average of 4 times-per-student). Nearly all (10 of 11) reported voluntarily using it weekly or semi-weekly, without cueing. Learners also initiated use of the job aid in their peer critiques, using it to recall the strategies recommended for various design outcomes. Utilization was also evident in the frequency with which learners carried the job aid to class.

Digital Job Aid

Students had requested a digital version of the job aid on the same day the paper-based version was released, as they believed having this tool readily available online would increase their usage. In order to evaluate the effectiveness of putting together a digital job aid, we checked on their utilization of the alternative tool, given that this was a requested addition to the original design. Surprisingly, there was little use (1 of 11) of the digital ILA, though the tool was readily accessible on the learning management system as requested. The compact size and portability of the paper-based job aid caused learners to keep it readily available, making it even more accessible than taking the extra steps necessary to access the digital version.

Principles of Design for ILAs from this Study

We synthesized our findings in this study with the principles from previous literature applicable to design of ILAs more generally. We developed a set of research-supported and emergent principles for designing tangible learning aids for face-to-face educational and training settings, and as post-training performance aids.

1. More complex content in ILAs may support interaction for learning, but also tends to reduce quickness of access and use for reference and transfer, so it presents tradeoffs for ILAs intended for both initial learning and later performance.
2. Portability of a tangible job aid promotes accessibility and may promote utilization.
3. Portability of a tangible job aid may present advantage over a similar digital tool for some users, tasks and contexts.
4. More complex factors than scaffolded use in train ing promote (or reduce) likelihood of learners' utilization of ILAs in transfer to performance.
5. Participatory design of ILAs by users may promote ownership and adoption for task performance.

Future Research

In preparing to build upon this research, data that provides more specific connections between the design features and learners' utilization could refine our understanding of the dynamic role of ILAs. In addition, a larger sample with even richer data would support more precise analysis for determining their role in learners' engagement and competence development. To support comparison of types and formats of ILAs, future studies should include parallel measures.

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